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(58) Field of search
G2C

(54) Photosensitive materials for making signs and labels

(57) Sign making materials are described consisting of two sheets which can be peeled apart and which are separated by at least two intermediate layers. One of the intermediate layers is a transparent or translucent layer of permanently tacky pressure sensitive adhesive. The other is an adhesive image-forming layer. The adhesive image-forming layer may be made up of several sublayers. After imagewise exposure of such material, the two outer sheets are peeled apart and the image-forming layer shears imagewise so that the peeled apart transparent or translucent sheet bears a pressure sensitive layer overall having thereon in image areas indicia formed of non-transparent or-translucent material from the image-forming layer and which has an outer adhesive surface.

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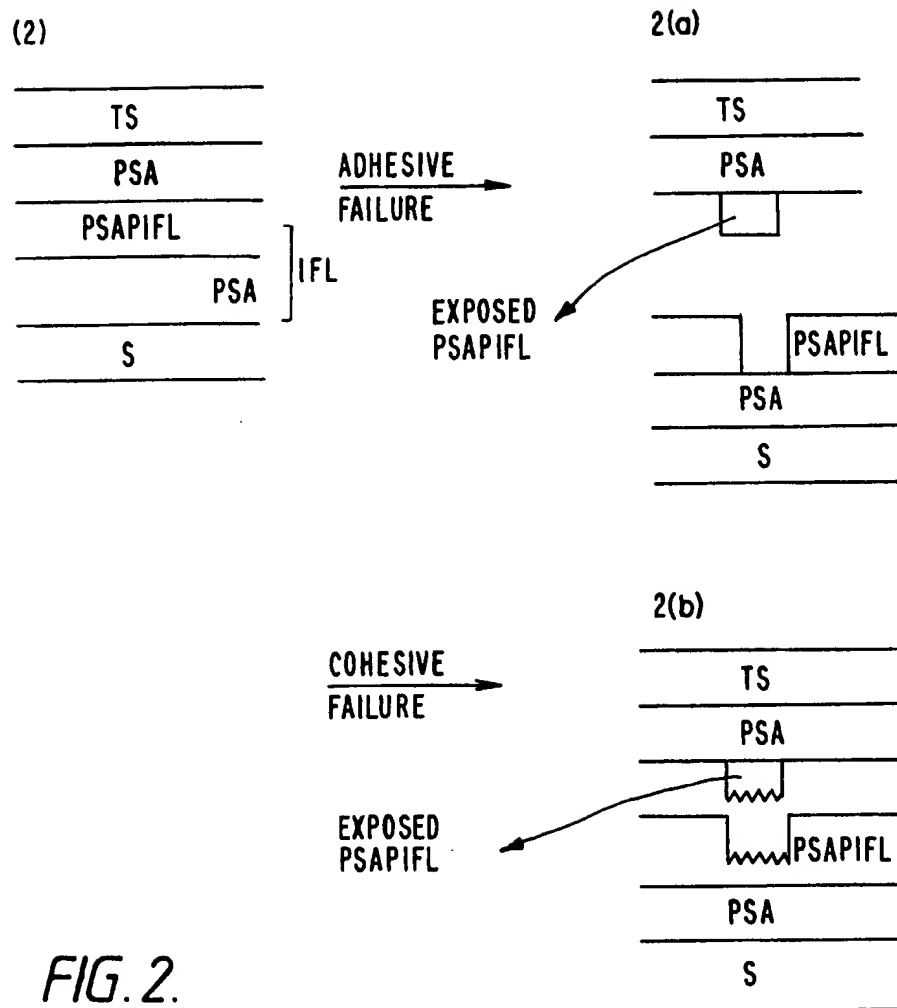


FIG. 2.

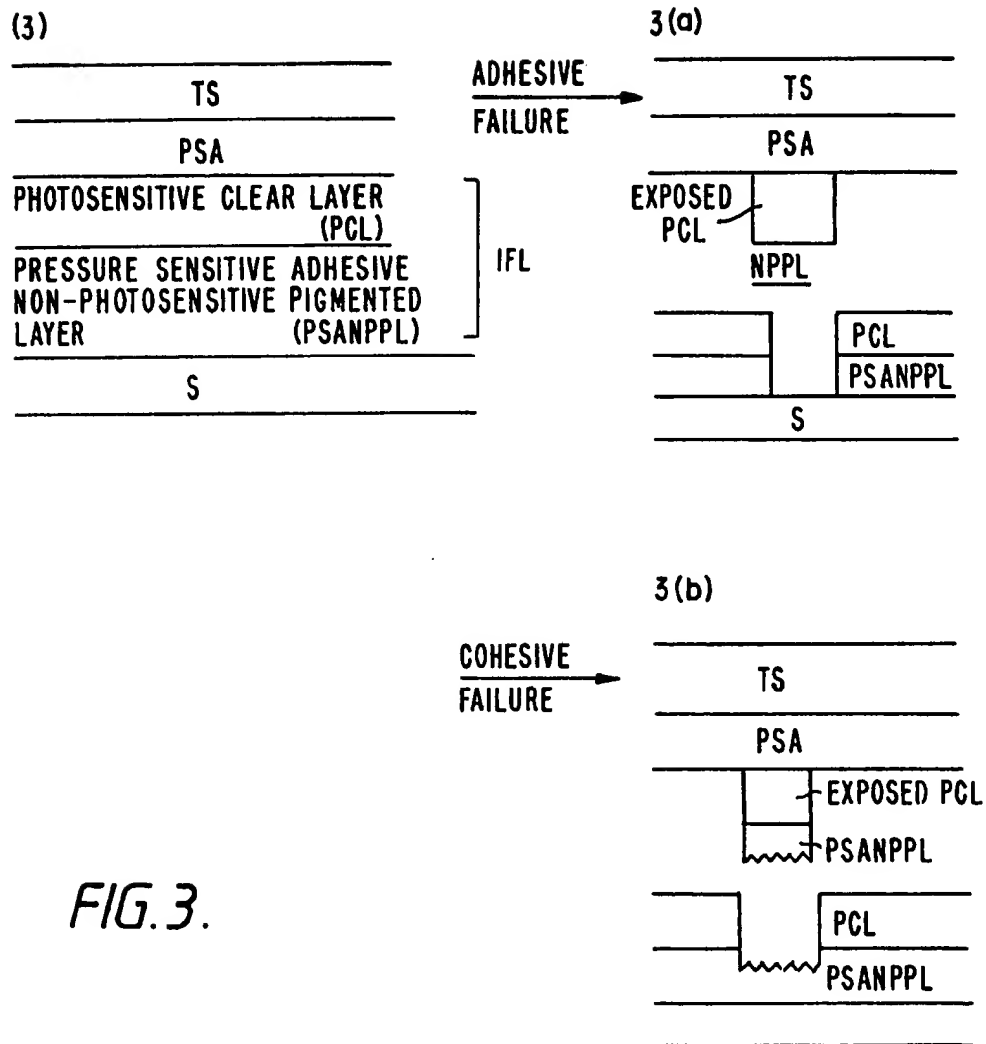
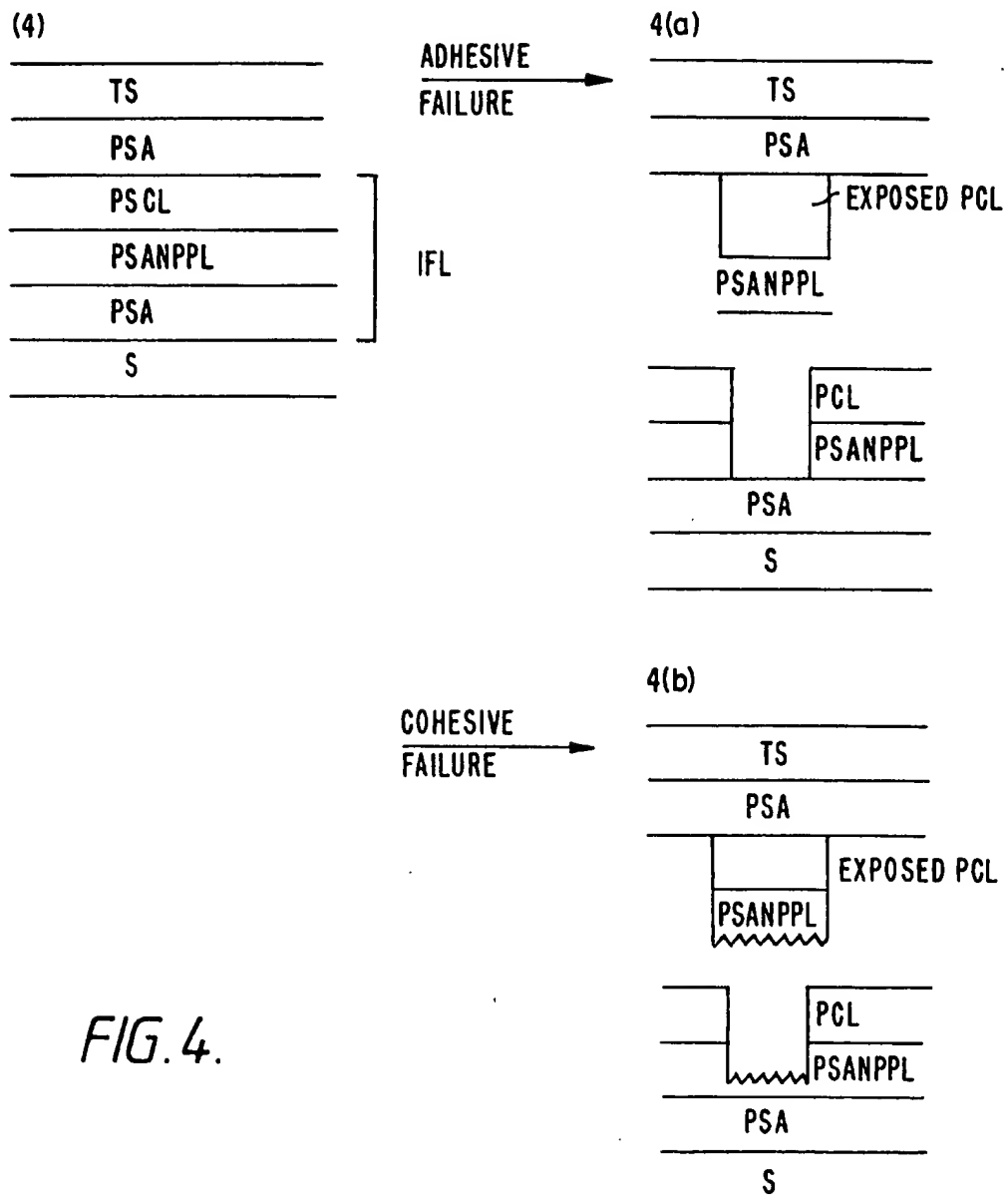
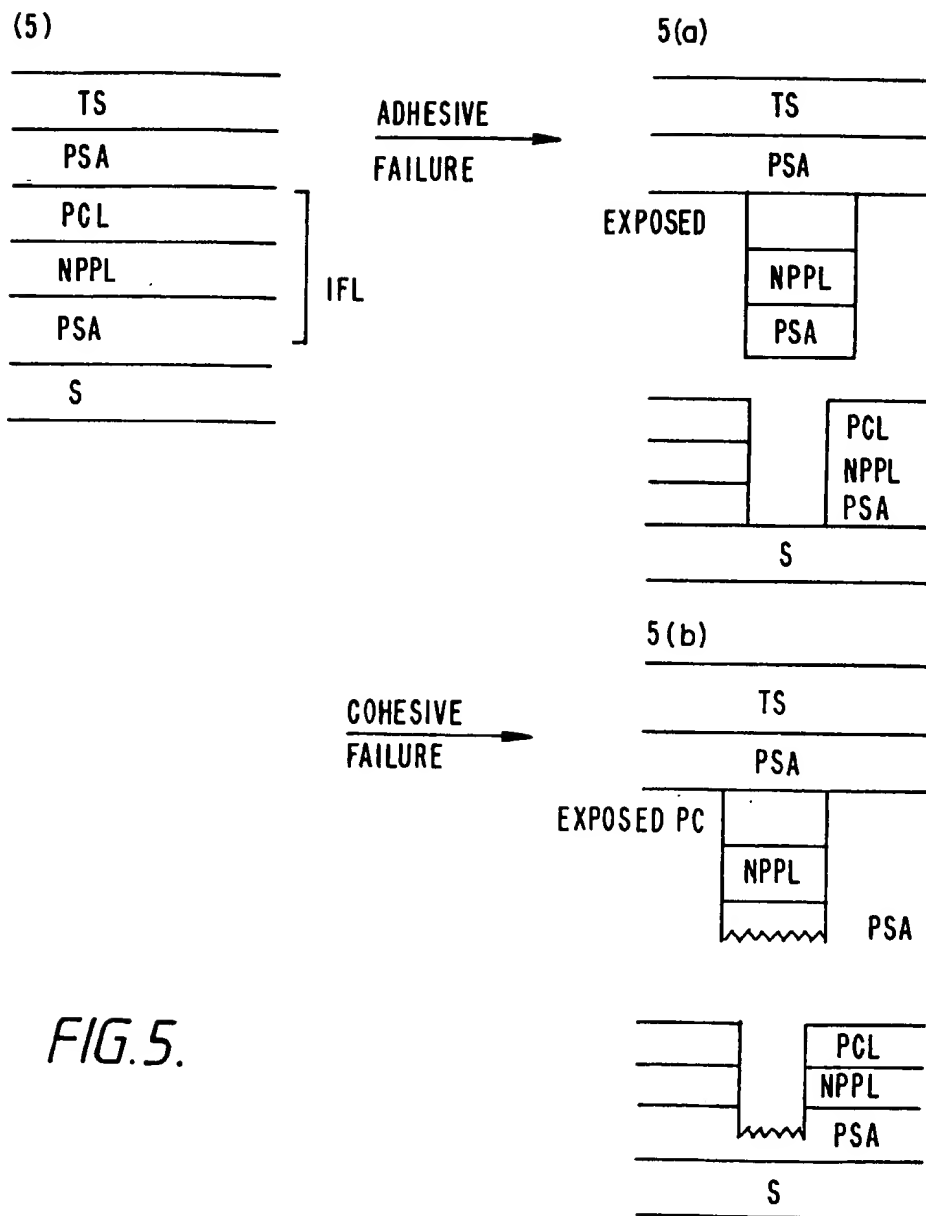


FIG. 3.





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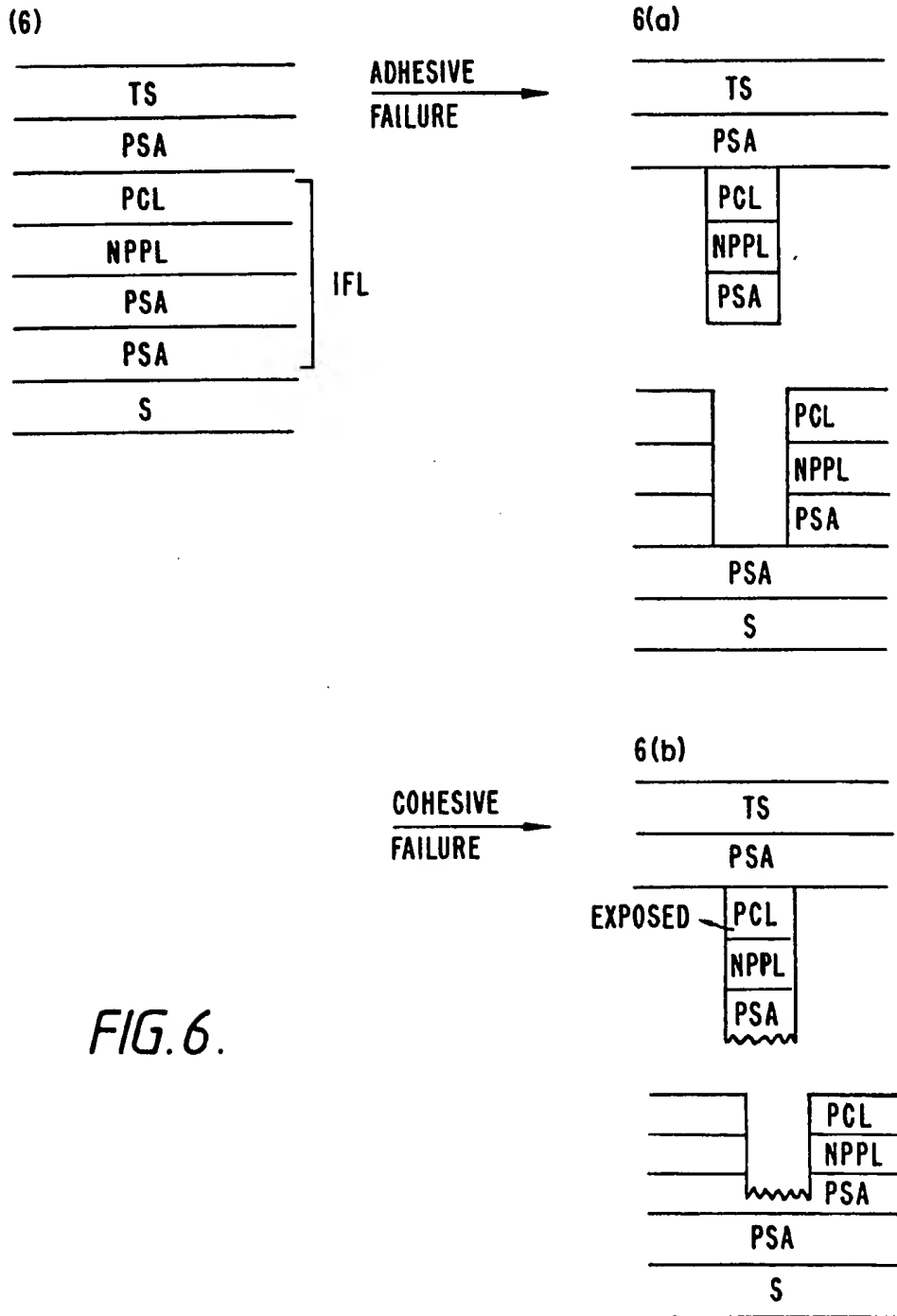


FIG. 6.

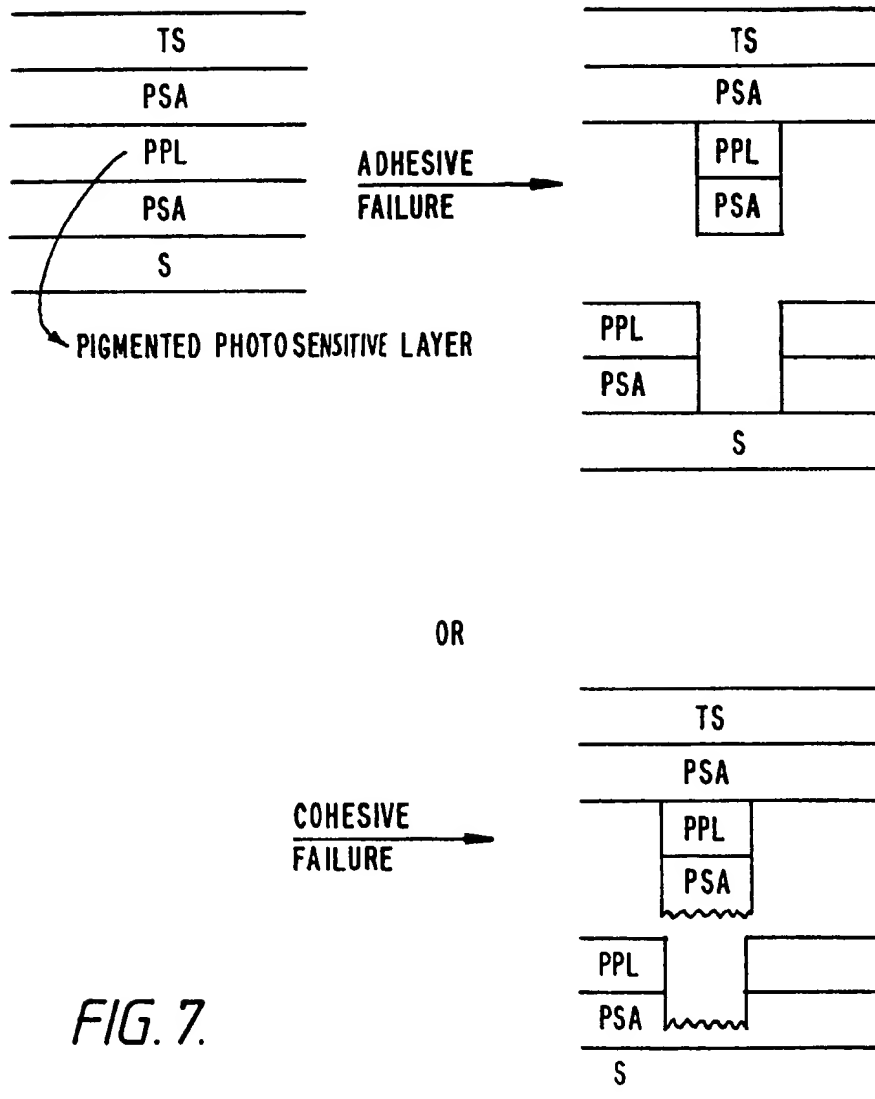


FIG. 7.

(1)

TRANSPARENT SUBSTRATE (TS)
PRESSURE SENSITIVE ADHESIVE (PSA)
PRESSURE SENSITIVE ADHESIVE PHOTOSENSITIVE IMAGE FORMING LAYER PSAPIFL
SUBSTRATE

ADHESIVE
FAILURE

1(a)

TS
PSA
EXPOSED PSAPIFL
PSAPIFL
SUBSTRATE

1(b)

EXPOSED
PSAPIFL

COHESIVE
FAILURE

FSA
EXPOSED PSAPIFL
PSAPIFL

FIG. 1.

SPECIFICATION

Photosensitive materials for making signs and labels

- 5 This invention relates to photosensitive materials for making signs and labels. 5
- Patent Specification 2053497 describes and claims sign making materials which consist of a pair of sheets which can be peeled apart, at least one of the sheets being transparent or translucent, wherein the sheets are held together by at least one transparent or translucent layer of permanently tacky pressure sensitive adhesive adjacent the or a transparent or translucent
- 10 sheet and an image-forming layer. The image-forming layer may either be a photosensitive non-transparent or translucent layer or it may be comprised of two layers, a first photosensitive but otherwise non-light absorptive layer adjacent the layer of permanently tacky pressure sensitive adhesive and a second layer which is non-photosensitive, and non-transparent or translucent. 10
- After image-wise exposure to actinic radiation and peeling apart of the sheets, the image-forming layer shears along the edges of the image areas so that the peeled apart transparent or translucent sheet bears a pressure sensitive adhesive layer which in turn bears, in the image areas, indicia formed of non-transparent or translucent material from the image-forming layer. 15
- Such photosensitive materials are negative working and act effectively to produce adherent labels when exposed and peeled apart. The effectiveness of the label is, however, substantially diminished if the image area constitutes a substantial proportion of the overall area. Thus for labelling tapes imaged with a succession of letters, the product works well with small letters but not so well with large letters, e.g. in heavy typeface which occupies a substantial area of the tape. 20
- According to the present invention there is provided a sign making material which consists of the following components: 25
1. a first transparent or translucent sheet;
 2. a transparent or translucent layer of permanently tacky pressure sensitive adhesive;
 3. an adhesive image-forming layer, which image-forming layer comprises
 - i) a layer which is both photosensitive and non-transparent or translucent, or
 - 30 ii) a first layer which is photosensitive but otherwise non-light absorptive adjacent the layer of permanently tacky pressure sensitive adhesive and, adjacent this first layer, a second non-photosensitive layer which second layer is non-transparent or translucent, 30
- wherein the image-forming layer also comprises a permanently tacky pressure sensitive adhesive component, either as a separate layer on top of layer (i) or the second layer of (ii), or 35
- 35 incorporated into layer (i) or the second layer of (ii), and
4. a second sheet adherent to the image-forming layer, 40
- wherein after image-wise exposure to actinic radiation and peeling apart of the sheets the image-forming layer shears along the edges of the image areas so that the peeled apart transparent or translucent sheet bears the pressure sensitive adhesive layer overall having 40
- 40 thereon in image areas indicia formed of non-transparent or translucent material from the image-forming layer and having an outer adhesive surface.
- By working in this way, the whole of the outer surface of the imaged and peeled apart transparent or translucent sheet is adhesive and can accordingly be adhered where desired. Labels produced in this way adhere well irrespective of the proportion of their surface area 45
- 45 occupied by the images.
- It can be seen that the sign making material according to the present invention may take one of four forms depending upon whether the permanently tacky pressure sensitive adhesive is separate from the image forming layer or is incorporated into the image forming layer and depending on whether the image forming layer itself consists of a single layer as in 3(i) or a dual 50
- 50 layer as in 3(ii). Of these, the least preferred is the case where the pressure sensitive adhesive component is present as a separate layer on top of a unitary photosensitive non-transparent or translucent layer. In such types, the photographic response time may be substantial due to the presence of e.g. light-absorbent material throughout the photosensitive layer.
- It is particularly advantageous to incorporate a further layer of pressure sensitive adhesive 55
- 55 between the adhesive image forming layer item 3 and the second sheet item 4. This further layer of pressure sensitive adhesive is preferably applied to the second sheet and has the effect of a subbing layer enabling the adhesion of the adhesive image forming layer 3 to the second sheet to be defined or controlled. Variations in the properties of the second sheet in raw material terms may be compensated for by the use of an appropriate coating of pressure sensitive 60
- 60 adhesive on that sheet. It is particularly advantageous to incorporate in any such additional layer of pressure sensitive adhesive a pigment since this acts to modify the adhesiveness of the pressure sensitive adhesive, simple variation of pigment content enabling variation in the adhesive properties of the extra layer to be easily achieved.
- Preferably the image-forming layer comprises a first layer which is photosensitive but 65
- 65 otherwise non-light absorptive adjacent the layer of pressure sensitive adhesive and a second

layer adjacent the first layer which is non-photosensitive, non-transparent or translucent, and which incorporates a pressure sensitive adhesive component.

Probably the individual components of the various layers are so chosen that image shearing takes place throughout the entire depth of the image-forming layer. However, this is not absolutely necessary insofar as it is possible for the image-forming layer to shear around the edges of the images and also to fail cohesively across the areas of those images. 5

The selection of suitable materials for the transparent or translucent sheet, the second sheet, the permanently tacky pressure sensitive adhesive and the components of the image-forming layer may be made in accordance with known principles and specifically may be as suggested in Specification 2053497 the whole of the disclosures of which are incorporated herein by such reference. 10

For a clearer understanding of the various types of material encompassed within the scope of the present invention and the modifications which may be made thereto, reference may be had to the accompanying drawings. Each of these drawings is a diagrammatic representation of a section of sign making material in accordance with the present invention both prior to exposure and following exposure and peeling apart, the exposure taking the form of irradiation by actinic light to a central portion of the section illustrated. 15

As is well known, the mechanism of failure in peel apart materials as described in the specification referred to above and also in the case of the materials according to the present invention, is cohesive or adhesive. The separation naturally occurs at the weakest link in the chain of materials across the laminate, and the weakest link may either be the adhesion between two adjacent layers or may be the internal cohesive strength of a layer. Both failure mechanisms are possible in the materials according to the present invention and each of the diagrammatic Figures shows the mode of operation of such materials which are adjusted to fail adhesively or cohesively. Determination of which link in the chain is the weakest can be effected without difficulty by appropriate formulation of the materials used to make the various layers. 20 25

It is believed that the diagrams are largely self explanatory. In the accompanying seven Figures, Figs. 1, 3, 5 and 7 show the four main types of product in accordance with the invention. Figs. 2, 4 and 6 show product types corresponding to Figs. 1, 3 and 5 respectively but with the addition of an extra layer of pressure sensitive adhesive applied on the second sheet. 30

The manufacture of the multilayer materials in accordance with the present invention may take place in any convenient fashion. Generally speaking, it is preferred to coat the transparent or translucent sheet and the second sheet with respective layers of pressure sensitive adhesive, to coat one of them with a photosensitive layer and then to laminate the two so-coated sheets together. 35

The following examples will serve to illustrate the invention.

EXAMPLE 1

This is an example of a material constructed in accordance with Fig. 4 of the accompanying drawings and which operates by adhesive failure as illustrated at 4(a). 40

A pigmented adhesive was made by ball milling for 48 hours a mixture of the following ingredients in the following proportions by weight:

45	Silicon adhesive (DC 282 ex Dow Corning Ltd.)	10 parts	45
	Xylene	90 parts	
	Carbon black (Elftex 150 ex Cabot Carbon Limited)	2.5 parts	

50 The adhesive composition was then coated using a No. 20 Meyer bar on to release paper (Quicklease 30/102 ex Jointine Limited) and the coated sheets were dried in an oven at 50°C. for 5 minutes.

An image-forming layer was made by coating the pigmented adhesive layer using a No. 20 Meyer bar and drying the coating at 50°C. for 10 minutes using a coating composition consisting of the following ingredients in the following proportions by weight: 55

	Polyvinyl alcohol (10% by weight solution in water, Gelvatol 40-10 ex Monsanto)	90 parts	
5	Carbon black (Elftex 150)	30 parts	5
	Hydroxyethyl cellulose solution (2% by weight solution in water, Natrasol HHR ex Hercules Limited)	120 parts	
	Water	240 parts	
10	Non-ionic surfactant (Anonaid TH ex ABM Limited)	10 parts	10
	Pressure sensitive acrylate adhesive (emulsion form, Vantac 343 ex Bevaloid)	118 parts	
15	The polyvinyl alcohol and carbon black were ball milled together for 48 hours prior to the addition of the other ingredients.		
	A photosensitive coating composition was compounded from the following ingredients in the following proportions by weight:		
20	Acrylic monomer (Setalin AM 548, ex Synthese BV)	60 parts	20
	Photoinitiator solution (33% by weight solution of isopropyl thioxanthone (Quantacure ex Ward Blenkinsop) in an amine (Quantacure BEM ex Ward Blenkinsop))	5 parts	
25	Non-ionic surfactant (Synperonic NP8 ex ICI Limited)	5 parts	25
30	Acrylic copolymer emulsion (National EP4711 ex National Adhesives Limited)	40 parts	30
	Water	30 parts	
35	The photosensitive layer was formed by coating this composition on to the dried coating of the image-forming layer using a No. 25 Meyer bar. The coating was dried at 50°C. for 10 minutes.		
	Sheets of polyethylene terephthalate 36 microns thick (Melinex 542 ex ICI Limited) were then coated with an equal parts by weight mixture of xylene and the silicone adhesive used above (DC 282). Coating was effected using a No. 25 Meyer bar and the coating was dried at 60°C.		
40	following which the coated polyethylene terephthalate sheets were laminated to the coated release paper sheets. Lamination temperature was 70°C., lamination speed 4 m/min. and the lamination was effected by passing the two sheets through a nip between two rollers of diameter 10 cm. having a surface of rubber of Shore hardness 70-80 and just touching in absence of any interposed material.		40
45	The laminate so obtained was imagewise exposed through a transparency to ultraviolet light from a 2kw mercury metal halide lamp at a distance of 1 m. Exposure time was 5 seconds and exposure took place through the polyethylene terephthalate layer. Following exposure the polyethylene terephthalate sheet and the release paper were promptly peeled apart to reveal negative black images on the polyethylene terephthalate sheet. The surface of the images		45
50	remote from the sheet felt distinctly tacky and the whole sheet could be adhered to a desired receptor surface by hand, conveniently using a hand-held roller to exclude air bubbles.		50

EXAMPLE 2

55	This is an example of a material constructed in accordance with Fig. 1 of the accompanying drawings and which operates by adhesive failure as indicated at 1(a).			55
	Polyethylene terephthalate sheet 75 microns thick (Melinex 542 ex I.C.I.) was coated with a photosensitive composition using a No. 20 Meyer bar. The coated sheets were dried at 60°C. The coating composition consisted of (parts by weight):			

	Acrylic copolymer emulsion (XX10/10 experimental emulsion (Bevaloid emulsion ex Bevaloid Ltd.))	70 parts	
5	Oligo triacrylate (OTA 480 ex UCB BV)	25 parts	5
	Water	20 parts	
	Carbon black dispersion	4.5 parts	
	Surfactant (Synperonic NX ex I.C.I.)	1 part	
10	Photoinitiator (Quantacure ITX (33% by weight solution in Quantacure BEA ex Ward Blenkinsop))	3.2 parts	10
	Pressure sensitive acrylic adhesive (Vantac 343 ex Bevaloid Ltd.)	12.3 parts	
15	The carbon black dispersion was made by ball milling 10 parts by weight carbon black (Elftex 150 ex Cabot Carbon) in 90 parts by weight of a 10% by weight polyvinylalcohol solution in water (Gelva 40-20 ex Monsanto). Separately a coating composition was made of an equal weight mixture of silicone adhesive (DC 282 ex Dow Corning) and xylene and this mixture was coated on to polyethylene terephthalate sheets of the same type and dried at 60°C. Coating was with a No. Meyer bar. The two polyethylene terephthalate sheets were then laminated together by passing through a heated nip (70°C) at a speed of travel of 4m/minute. The nip gap was 0.0 mm and the nip rollers were made of rubber of Shore hardness 70-80.		
20	The photosensitive material thereby obtained was then exposed to actinic radiation via an image bearing transparency which was in contact with the polyethylene terephthalate sheet adjacent the silicone adhesive layer. After exposure from 2 Kw mercury metal halide arc at a distance of 1m for 7.5 seconds, the substrates could be peeled apart to leave on the polyethylene terephthalate sheet bearing the silicone adhesive coating a black, permanently tacky image corresponding to the original.		
25			
30			

EXAMPLE 3

This is an example of a material constructed in accordance with Fig. 3 of the accompanying drawings and which operates by adhesive failure as indicated at 3(a).

35	Silicon adhesive coated sheets of polyethylene terephthalate were prepared as in Example 2. Sheets of silicone release paper (30/102 ex Jointine Limited) were then coated using a No. 15 Meyer bar with a pressure sensitive adhesive non photosensitive pigmented layer from a coating composition and then dried at 60°C. The coating composition was as follows (parts by weight):		35
40			40
	Polyisobutylene (Hyvis 200 ex B.P. Limited)	65 parts	
	Polyisobutylene (Oppanol B50 ex BASF)	43 parts	
45	Tackifier (Stabalite ester 10 ex Hercules Powder Co. Ltd)	17.5 parts	45
	Carbon black (Elftex 150 ex Cabot Carbon)	53.6 parts	
	Finely divided silica (Aerosil 300 ex Degussa)	6.7 parts	
50	2-ethoxy ethanol	20 parts	50
	Silicone adhesive (DC282 ex Dow Corning)	14.7 parts	
	Hydrocarbon solvent (Exsol ex B.P. Limited)	1153 parts	
55			55

After drying the sheets were overcoated using a No. 20 Meyer bar with a photosensitive coating composition as set out in Example 1 and this coating was then dried at 60°C.

60	The coated silicon release paper sheets thus obtained were then laminated to the silicone adhesive coated polyethylene terephthalate sheets by passing through a heated nip as set out in Example 2 and the laminate then exposed as likewise set out in Example 2. On peeling apart the sheets after exposure, permanently tacky black images corresponding to the exposed portions were left on the polyethylene terephthalate sheets.			60
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65	The words ELFTEX, QUIKLEASE, GELVA, GELVATOL, NATRASOL, ANONAIID, VANTAC, SETALIN, QUANTACURE, SYMPERONIC, OPPANOL, HYVIS, STABALITE, AEROSIL, EXSOL			65
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and MELINEX used herein are Registered Trade Marks.

CLAIMS

1. A sign making material consisting of the following components:
 1. a first transparent or translucent sheet;
 2. a transparent or translucent layer of permanently tacky pressure sensitive adhesive;
 3. an adhesive image-forming layer, which image-forming layer comprises
 - i) a layer which is both photosensitive and non-transparent or translucent, or
 - ii) a first layer which is photosensitive but otherwise non-light absorptive adjacent the layer
 - of permanently tacky pressure sensitive adhesive and, adjacent this first layer, a second non-photosensitive layer which second layer is non-transparent or translucent, wherein the image-forming layer also comprises a permanently tacky pressure sensitive adhesive component, either as a separate layer on top of layer (i) or the second layer of (ii), or incorporated into layer (i) or the second layer of (ii), and
 4. a second sheet adherent to the image-forming layer, wherein after image-wise exposure to actinic radiation and peeling apart of the sheets the image-forming layer shears along the edges of the image areas so that the peeled apart transparent or translucent sheet bears the pressure sensitive adhesive layer overall having thereon in image areas indicia formed of non-transparent or translucent material from the image-forming layer and having an outer adhesive surface.
2. A sign making material according to claim 1 and incorporating a further layer of pressure sensitive adhesive between the adhesive image-forming layer (3) and the second sheet (4).
3. A sign making material according to claim 2 wherein the further layer of pressure sensitive adhesive has been formed by coating onto the second sheet (4).
4. A sign making material according to claim 2 or 3 wherein a pigment is incorporated in the additional layer of pressure sensitive adhesive.
5. A sign making material according to any one of claims 1 to 4 wherein the image-forming layer comprises a first layer which is photosensitive but otherwise non-light absorptive adjacent the layer of pressure sensitive adhesive (2) and a second layer adjacent the first layer which is non-photosensitive, non-transparent or -translucent and which incorporates a pressure sensitive adhesive component.
6. A sign making material according to claim 1 and substantially as hereinbefore described with reference to any one of the accompanying Figs. 1 to 7.
7. A sign making material substantially as hereinbefore described with specific reference to any one of the foregoing specific Examples.